FORM PTO-1390 (REV. 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: BHTH 5440

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 09/831585

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP99/06812	14-09-1999	

TITLE OF INVENTION: DEVICE FOR THERMAL STERILIZATION OF LIQUIDS

APPLICANT(S) FOR DO/EO/US: Biermaier, Hans

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [X] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [ ] The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is attached hereto (required only if not communicated by the International Bureau).
   b. [XX] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [XX] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [XX] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [ ] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [X] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [XX] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [ ] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [ ] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [ ] Other items or information:

U.S. APPLICATION NO (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
09/831585	PCT/EP99/06812	BHTH 5440

21. ☒ The following fees are submitted:	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1000.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$860.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$710.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$690.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 860.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$ N/A	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	$	
Total claims	10 -20 =	-0-	x **$18.00**	$ N/A	
Independent claims	1 -3 =	-0-	x **$80.00**	$ N/A	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$270.00**	$ N/A	
			TOTAL OF ABOVE CALCULATIONS =	$ 860.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.			+	$ N/A	
			SUBTOTAL =	$ 860.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$ N/A	
			TOTAL NATIONAL FEE =	$ 860.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ N/A	
			TOTAL FEES ENCLOSED =	$ 860.00	
			Amount to be refunded:	$ N/A	
			charged:	$	

a. ☒ A check in the amount of $ 860.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 19-1345. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Senniger, Powers, Leavitt & Roedel
One Metropolitan Square, 16th Floor
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314-231-5400

SIGNATURE

Michael G. Munsell
NAME

43,820
REGISTRATION NUMBER

Device for Thermal Sterilization of Liquids

Description

The invention refers to a device for thermal sterilization of liquids, in particular drinking water, in accordance with the generic part of Claim 1.

One such device for sterilization of drinking water is known from DE 195 22 234 A1. This device is a pump that draws in the water to be sterilized and pumps it through the heating section of a counterflow heat exchanger into a boiler, where it is heated in order to eradicate microbes or bacteria. The heating water is pumped back out of the boiler through the cooling section of the heat exchanger and there it is cooled to the usage temperature as it gives up heat to the incoming water in the heating section.

DE 31 19 632 A1 describes a sterilization unit for milk, which has a milk flow loop and a heat exchanger circuit that is separated from the milk circuit, and the two circuits are thermally connected to each other by two common heat exchangers.

A device for heat sterilization of pumpable foods is known from DE 42 00 588 A1; it essentially consists of a horizontally arranged spiral tube that is half filled with the semi-liquid food and half with steam. By rotating the spiral tube the semi-liquid food is transported and sterilized.

DE 40 03 987 C2 describes the heat exchanger with two liquid circuits that is used for thermal sterilization.

A spiral tube heat exchanger with a cylindrical housing that has a tangentially arranged inlet flow channel for a first medium whose cross section can be varied by means of a throttle diaphragm is known from DE 39 25 795 A1. In the housing there is a spiral channel through which the second medium flows. The incoming first medium at first flows along the wall of the housing and then between the individual

windings of the spiral up to its center and [from] there it flows out of the housing through an outlet channel.

DE 32 02 587 A1 describes a spiral heat exchanger that is made of ceramic material, consists of three separate flow channels and is intended for heat exchange between flue gas and liquids.

A similar spiral heat exchanger is described in DE 29 21 841, which has one spiral channel for the flow of a medium that is to be cooled, and two, also spiral, separate cooling channels.

A spiral heat exchanger that has a cylindrical housing in which there is a spirally shaped sheet metal strip that separates the flow channels for the heat exchange media is known from DE 35 09 226 C2.

DE 31 22 947 A1 describes several spiral heat exchangers whose tubes are soldered to each other at the contact surfaces. These heat exchangers have various tube cross sections and various spiral forms such as spirals with circular, rectangular, octagonal or conical outline.

A spiral heat exchanger whose spiral channels are arranged in two housing halves separated by a dividing wall is known from DE 33 19 521 C2. The medium to be cooled flows through an inlet in one of the housing halves, from there it flows in a spiral channel inwardly into a chamber at the center of the housing, from the chamber it flows into the second housing half and from there it flows to a corresponding channel to an outlet in the second housing half. The cooling medium flows in the opposite direction from the second into the first housing half through spiral channels.

The task of the invention is to design for thermal sterilization of liquids, especially drinking water, that can be produced simply and cheaply, is compactly constructed, and has low energy consumption.

This task is solved by the characteristics of Claim 1. Advantageous embodiments and further developments of the invention can be learned from the subordinate claims.

The invention is based on the idea of using of counterflow heat exchanger with a heat source arranged in its center for thermal sterilization of liquids.

The heat source is surrounded by a spiral-shaped conduit through which the liquid to be sterilized flows. The conduit is preferably formed by flexible films, which can be metal or plastic, and is wrapped around the heat source in a "spiral-like" fashion. The term "spiral-like" here should not be understood as a rigorously mathematical expression, but rather it means that the individual windings of the conduit are arranged "one on top of the other" and touch each other, i.e., the conduit windings in cross section can lie in a plane or can be arranged spherically around the heat source - similar to a mathematical spiral. The conduit has two flow channels, specifically a supply channel to the heat source, the heating section of the heat exchanger, and an exit channel from the heat source, the cooling section of the heat exchanger. Since the individual conduit windings are in contact, except for the outermost and innermost winding, each region of the heating section is in heat exchange contact on both sides with a cooling section and each region of the cooling section is in heat exchange contact on both sides with a heating section. In doing so, the liquid flowing in the heating section is preheated by heat exchange with the liquid flowing in the cooling section, heated by the heat source to the sterilization temperature, and then cooled in the cooling section.

The spiral-like arrangement of the conduit is achieved simply by "wrapping" the heat source using a conduit of an elastic, i.e., easily bended material, and this arrangement enables an optimum, i.e., rapid and low-loss, heat transfer

to the liquid to be sterilized. Through the continuous heat exchange between the cooling sterilized hot water and the cold water being supplied for sterilization one thus achieves a relatively high preheating temperature, so that a relatively small heat source power is sufficient to achieve the maximum temperature necessary for sterilization. In addition, the sterilized water is again cooled nearly to the usage temperature through the heat exchange and for this reason can be used immediately.

Wrapping the heat source with the elastic conduit further has the advantage that the device can be made very compact and even very high liquid vapor pressures that arise near the heat source, i.e., in the "inner" conduit windings, become distributed to all of the winding, which allows the use of low cost elastic conduit materials. Particularly uniform distribution of the liquid pressure and at the same time very compact construction can be achieved by a spherical arrangement of the conduit. Through the elasticity of the conduit it is further ensured that the individual conduit windings, due to vapor pressure or water pressure-related expansion, are in intimate contact and good heat transfer is achieved.

Since temperature of 100 to 150°C are achieved in the vicinity of the heat source and thus the water evaporates locally, the short term overpressure of the flexible conduit that arises in this case becomes distributed over the entire heat exchanger. When this occurs, because of the flexibility of the conduit, the channels with relative overpressure expand and the channels with relatively low pressure become contracted, so that a peristaltic motion arises, which promotes additional transport of the water, in addition to the water pressure at the heat exchanger inlet. In combination with a check valve at the inlet, a surging or pulsing water flow through the heat exchanger with phases of

higher and lower flow velocity is obtained in this way. Because of this "pump effect," the device operates even with very minimal water pressure at the heat exchanger inlet. Contamination and calcification of the heat exchanger are prevented by the phasewise high flow velocity.

In the heating section there is a device, for example a check valve, that enables liquid flow only in the direction toward to the cooling section and prevents backflow to a water supply, for example a supply main, to which the heating section of the device is connected. The heating of the water to 100 or 150°C, for example, produces, specifically in the conduit, pressures of several bars, which can be greater than the water pressure in the supply main, so that the check valve prevents backflow. The check valve is closed until the water pressure in the conduit has fallen to or below the water pressure in the supply main through the flowing of water out of the cooling section, so that fresh water to be sterilized can flow in afterward. The check valve is preferably arranged at the inlet to the heating section, i.e., directly at the connection site to the water supply.

The device in accordance with the invention can be used in many ways, since only an energy supply, for example, an electric power connection for the heat source, and a water connection are necessary, and operation is possible even at relatively low water pressures. For example, this allows use in private households, clinics, as an intermediate unit for other machines, even in developing countries, where drinking water has to be sterilized cheaply in suburban areas.

According to one further development of the invention, the conduit consists of two elastic films that are welded to each other at their lengthwise edges. Alternatively, it is possible to make the conduit of three film layers welded to each other at their lengthwise edges, where the ends of the

two outermost films are also welded to each other at one end of the conduit. Flexible metal or plastic films, for example, can be used as materials. Alternatively, it is also possible to use as the conduit two elastic tubes, especially capillary tubes or hoses, that have been telescoped one inside the other, where the two conduit sections are formed by the annular space between the two tubes and by the inner tube. It is also possible to use parallel tubes or hoses that are also in good thermal contact with each other due to the "wrapping."

The invention is illustrated in more detail below by means of embodiment examples. Here:

Figure 1a shows a first embodiment example of a device in accordance with the invention;

Figure 1b shows a second embodiment example of a device in accordance with the invention;

Figure 2a shows a cross section through a conduit that consists of two films welded to each other;

Figure 2b shows the transition region between the first and second conduit sections of the conduit in Figure 2a;

Figure 3a shows a conduit that consists of three films welded to each other;

Figure 3b shows the transition region of the conduit of Figure 3a;

Figure 4a shows a conduit that consists of two tubes; and

Figure 4b shows the transition region of the conduit of Figure 4a.

Figure 1a shows a device 1 for thermal sterilization of liquids that consists of a cylindrical housing 2, in which a conduit 3, which is wound into a spiral and which has a heating section 4 and a cooling section 5, is arranged. At the inlet end 6 of the heating section 4 there is a check valve 7 and a connection fitting 8, which the device can be

connected to a water supply such a water tap. The check valve 7 enables flow of water into heating section 4 in the direction indicated by arrow 9 and prevents backflow to the water supply. At the outlet end 10 of the cooling section 5 there is a connection fitting 11 with an open outlet fitting 12, from which the water can flow unhindered or to which a hose, a machine, etc., can be connected.

In the middle of the housing 2 there is a heating device 13, which is for example electrically heated and here consists of a cylindrical heat source housing 13a and a heating coil 13b arranged in it, which is supplied with current via a supply cable 14 that is brought out of housing 2 or via a plug 15. The heat source housing 13a has an inlet opening 13c for the supply of water that is to be heated, which is connected to heating section 4, and an outlet opening 13d for the output of heated water, which is connected to conduit section 5. Of course, the heating coil 13b is electrically insulated from the liquid flowing past it.

Water that enters the heating section 4 via the connection fitting 8 and check valve 7 flows up to middle of the "conduit spiral" in the direction indicated by arrow 15 and is gradually heated by the return flow of water in cooling section 5. In one region 16, in the inner part of the heat source housing 13a, the water reaches its maximum temperature and then flows outward, as indicated by arrows 17 and 18, into the "conduit spiral" up to the end of cooling section 5. There the water flows through the connection fitting 11 and the outlet fitting 12, as shown by arrows 19 and 20.

Because of the intimate two-sided contact of the conduit section 4 and 5, the water flowing in through the heating section 4 is preheated by the water flowing out in cooling section 5 and the water flowing out in cooling

section 5 is cooled by the water flowing in heating section 4. Thus, an "internal" heat exchange takes place via the linings of the first section 4 and cooling section 5, which are in contact with each other. This has the advantage that the water flowing in heating section 4 has been preheated to an already relatively high temperature in the innermost winding of the "conduit spiral" and can be heated to the desired sterilization temperature by a relatively low-power heat source, with the desired sterilization temperature being reached in the region 16 between the heating section 4 and the cooling section 5.

As an alternative to this embodiment example, in which conduit 3 is wound so that the individual conduit windings lie in a single plane in cross sections, an essentially spherical arrangement of the conduit 3 is also possible, in which only the supply of energy to the heating source, for example electrical wiring, possibly causes a departure from spherical form. Furthermore, instead of the inlet fitting 8 and the outlet fitting 12, sleeve joints can be provided, via which the device is connected to a piping system.

Figure 1b shows an embodiment example in accordance with the invention in which, in contrast to Figure 1a, the conduit sections 4 and 5 are not "connected" to the heat source housing and the water to be sterilized does not directly flow around heating coil 13b. Here the heat from heating 13b is transferred by thermal conduction through the heat source housing 13a to the conduit 3 that is wrapped around it or to the water flowing in this conduit, where the transition region between the heating section 4 and the cooling section 5 is designated by the number 21.

Figures 2a, 3a and 4a show cross sections through the conduit 3 and Figures 2b, 3b and 4b show lengthwise sections through the transition regions 21 of conduit 3 shown in Figure 1b.

The conduit shown in Figures 2a and 2b consists of two films 22 and 23, which are welded to each other in edge regions 24 and 25, where the water flows in the hollow space formed by the two films 22 and 23, which is indicated in Figure 2b by arrow 17. In the transition region 21 (see Figure 1b) between the heating section 4 and the cooling section 5 the conduit 3 is "reversed," so that the two conduit sections 4 and 5 are in contact, which enables good heat transfer. This kind of "reversed" double conduit can be spirally wrapped around the source.

Figures 3a and 3b show another embodiment example in which conduit 3 is formed of three elastic films, specifically films 22 and 23 and a dividing film 26 arranged between them. In correspondence with the embodiment examples in Figures 2a and 2b, films 22, 23 and 26 are welded to each other in their edge regions. A first hollow space 27, which lies between film 22 and dividing film 26 forms the heating section 4, and a second hollow space 28, which lies between film 23 and dividing film 26, forms cooling section 5. In contrast to the embodiment examples shown in Figures 2a and 2b films 22 and 23 are welded to each other at one end 29, which forms the transition region 21 between the heating section 4 and the cooling section 5. The dividing film 26 has a "free end" in transition region 21, which allows liquid flow from heating section 4 into cooling section 5 in correspondence with arrow 17.

Figure 4a shows another embodiment example, in which conduit 3 is formed by two tubes 31 and 32, one place inside the other. An annular space 33 lying between the two tubes 31 and 32 forms the heating section 4 (or the cooling section 5) and the hollow space 34 enclosed by the inner tube 32 forms the cooling section 5 (or the heating section 4). In the transition region 21 the tube 31 is closed by one end wall 35, while tube 32 is open there, so that water can

flow in the direction of arrow 17 from the heating section 4 [into] cooling section 5.

Claims

1. A device for thermal sterilization of liquids, especially water, with a counterflow heat exchanger that has a conduit with a heating section and cooling section, which are in a flow connection to each other, and with a heating source for heating the liquid,

which is characterized by the fact,

that the heating section and the cooling section are spirally arranged around the heat source (13),

the heat source (13) is essentially located in the center of the spiral,

conduit 3 consists of flexible, wrappable material,

individual windings of conduit (3) lie one on the other and contact each other, and

a device (7) that enables liquid flow only in the direction from the heating section (4) to the cooling section (5) is provided.

2. A device as in Claim 1, which is characterized by the fact that the fitting (7) is a check valve.

3. A device as in one of Claims 1 or 2, which is characterized by the fact that the fitting (7) is arranged on the heating section (4).

4. A device as in one of Claims 1 to 3, which is characterized by the fact that the fitting (7) is arranged at the inlet end (6) of the heating section (4).

5. A device as in one of Claims 1 to 4, which is characterized by the fact that the conduit (3) is formed by two elastic films (22, 23), which are welded to each other at their lengthwise edges (24, 25).

6. A device as in one of Claims 1 to 4, which is characterized by the fact that the conduit (3) is formed by three elastic films (22, 23), which are welded to each other at their lengthwise edges (24, 25), where two (22, 23) of these films are separated from each other by the third film (26).

7. A device as in one of Claims 1 to 4, which is characterized by the fact that the conduit (3) is formed by two tubular individual conduits (31, 32) arranged one inside the other in telescope fashion.

8. A device as in one of Claims 1 to 7, which is characterized by the fact that the individual windings of conduit (3) lie in the same plane.

9. A device as in one of Claims 1 to 7, which is characterized by the fact that the individual windings of the conduit (3) are arranged in a spherical form.

10. A device as in one of Claims 1 to 9, which is characterized by the fact that the conduit (3) consists of a metal film or a plastic film.

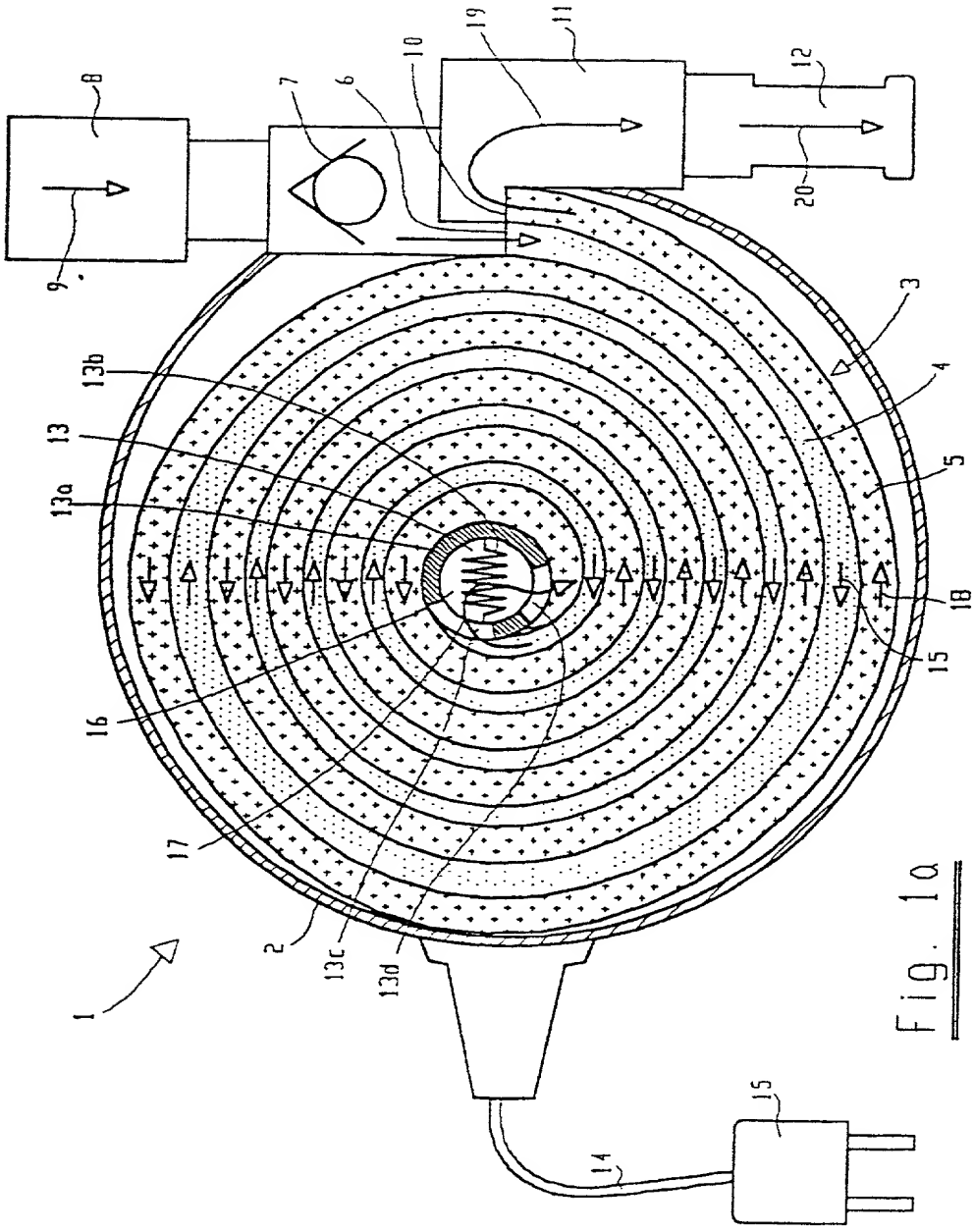

Fig. 1a

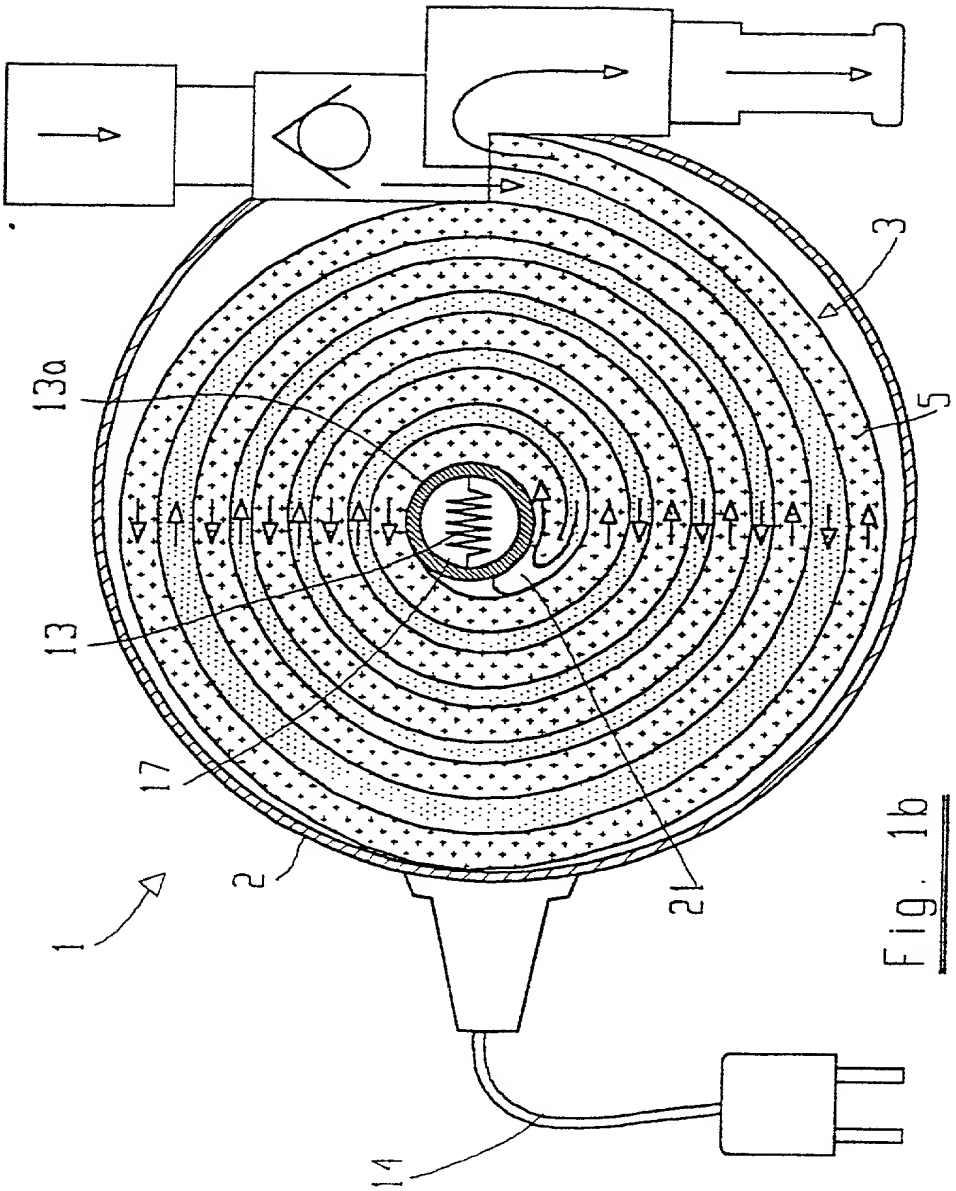

Fig. 1b

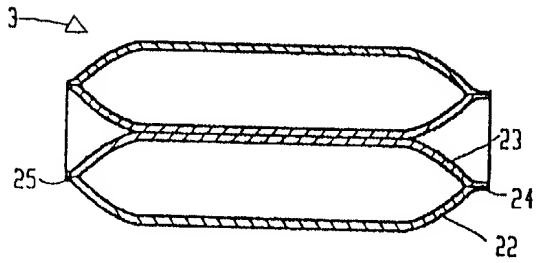

Fig. 2a

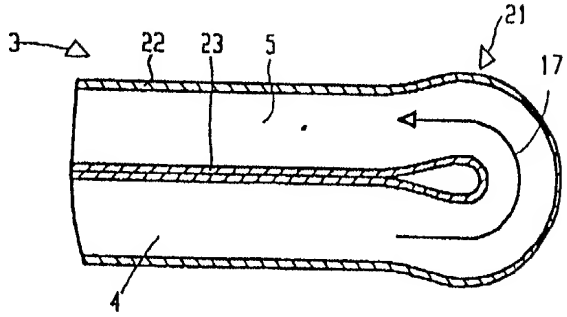

Fig. 2b

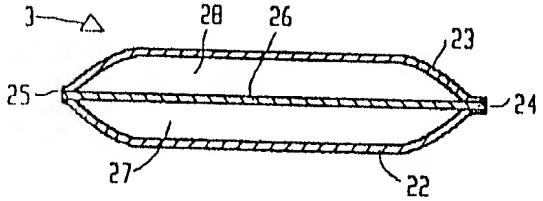

Fig. 3a

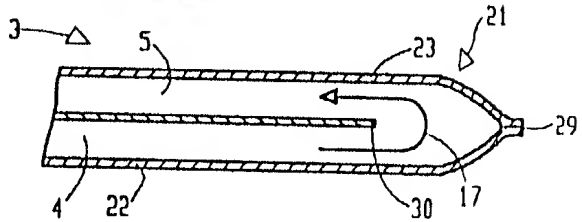

Fig. 3b

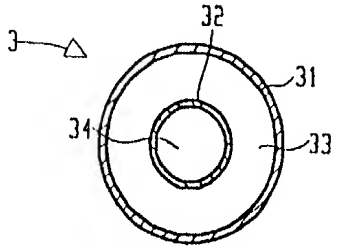

Fig. 4a

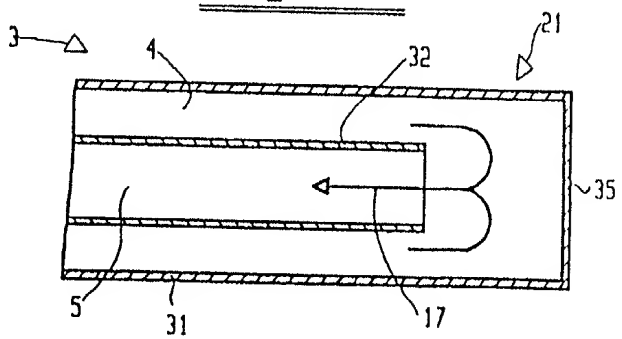

Fig. 4b

Attorney's Docket No. BHTH 5440

DECLARATION AND POWER OF ATTORNEY

REGULAR OR DESIGN APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

DEVICE FOR THERMAL STERILIZATION OF LIQUIDS

the specification of which:

(check one)

[ ] is attached hereto
[ ] was filed on _____ as Application Serial No. _____, and was amended on _____.
[X] was described and claimed in PCT International Application No. PCT/EP99/06812, filed on 09/14/99 and as amended under PCT Article 19 on _____, if any.

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations §1.56.

PRIORITY CLAIM

I hereby claim foreign priority benefits under Title 35, United States Code, §119 (a) - (d) or §365(b) of any foreign application for patent or inventor's certificate, or §365(a) of any PCT application which designates at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Priority Claimed

(Number)	(Country)	(Day/Month/Year Filed)
(Number)	(Country)	(Day/Month/Year Filed)
(Number)	(Country)	(Day/Month/Year Filed)

Priority Not Claimed

ANY FOREIGN APPLICATION(S), ON THE SAME SUBJECT MATTER WHICH HAS A FILING DATE EARLIER THAN THE EARLIEST APPLICATION FROM WHICH PRIORITY IS CLAIMED

(Number)	(Country)	(Day/Month/Year Filed)

CLAIM FOR BENEFIT OF PROVISIONAL APPLICATION(S)

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below.

(Application Number)	(Filing Date)
(Application Number)	(Filing Date)

CLAIM FOR BENEFIT OF EARLIER U.S. APPLICATION(S) UNDER 35 U.S.C. 120

(complete this part only if this is a divisional, continuation or CIP application)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s), or §365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Serial No.)	(Filing Date)	(Status)
(Serial No.)	(Filing Date)	(Status)

POWER OF ATTORNEY

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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